What is claimed is:

1. A method of manufacturing a microfabricated channel network, comprising:

providing a first planar substrate having a first surface;

depositing a first polymer layer on the first surface of the first substrate;

removing a first portion of the polymer layer to expose an area of the first surface of the first substrate, removal of the first portion of the polymer layer providing one or more grooves in the polymer layer that correspond to a desired channel pattern; and

overlaying a second planar substrate layer on the polymer layer to seal the one or more grooves in the polymer layer as one or more channels in the desired channel pattern.

2. The method of claim 1, wherein the first polymer layer comprises a photoimagable polymer layer, and the removing step comprises:

exposing first selected regions of the photoimagable polymer layer to effective levels of electromagnetic radiation, the selected regions either corresponding to the first portion of the first polymer layer or corresponding to the first polymer layer immediately surrounding but not including the first portion; and

removing the first portion of the photoimagable polymer layer.

3. The method of claim 2, wherein the photoimagable polymer comprises a positive photoresist, and wherein the selected regions exposed in the exposing step correspond to the first portion of the first polymer layer.

4. The method of claim 2, wherein the photoimagable polymer comprises a negative photoresist, and wherein the selected regions exposed in the exposing step correspond to the polymer layer immediately surrounding but not including the first portion.

5. The method of claim 2, wherein the exposing step comprises directing a light source at the photoimagable polymer layer through a mask, the mask comprising transparent regions that correspond to the one or more channels of the desired channel pattern.

6. The method of claim 2, wherein the exposing step comprises movably directing the light source at different portions of the photoimagable polymer layer.

7. The method of claim 6, wherein the light source comprises a coherent light source.

8. The method of claim 6, wherein the light source comprises a laser.

9. The method of claim 2, wherein the photoimagable polymer is selected from photoimagable polyimides, photoimagable benzocyclobutenes, photoimagable epoxies, novolac based positive photoresists, and cardo type photopolymers.

10. The method of claim 2, wherein the depositing step comprises spin coating the photoimagable polymer onto the first surface.

11. The method of claim 2, wherein the depositing step comprises laminating the photoimagable polymer onto the first surface.

12. The method of claim 2, wherein the depositing step comprises spray coating the photoimagable polymer onto the first surface.

13. The method of claim 2, wherein the photoimagable polymer layer is between about 1 µm and about 100 µm thick.

14. The method of claim 2, wherein the photoimagable polymer layer is between about 5 µm and about 50 µm thick.

15. The method of claim 2, wherein the irradiating step comprises directing light at the predefined locations of the photoimagable polymer layer, the light comprising light of a wavelength between about 190 nm and about 430.

16. The method of claim 2, wherein the overlaying step comprises bonding the second substrate layer to the layer of photoimagable polymer.

17. The method of claim 16, wherein the photoimagable polymer layer comprises an adhesive surface and the bonding step comprises pressing the second substrate layer to the layer of photoimagable polymer.

18. The method of claim 1, further comprising providing a groove in the first surface of the first substrate.

19. The method of claim 18, wherein the groove in the first surface of the first substrate intersects and is in fluid communication with the groove in the first polymer layer.

20. The method of claim 1, wherein a first surface of the second substrate is overlaid on the polymer layer, and further comprising:

depositing a second polymer layer on a second surface of the second substrate opposite the first surface of the second substrate;

removing a first portion of the second polymer layer to expose an area of the second surface of the second substrate, removal of the first portion of the second polymer layer providing one or more grooves in the second polymer layer that correspond to the desired channel pattern; and

overlaying a third planar substrate layer on the second polymer layer to seal the one or more grooves in the second polymer layer as one or more channels in the desired channel pattern.

21. The method of claim 1, wherein the polymer layer comprises a laser ablatable polymer layer, the first substrate comprises a non-ablatable substrate, and the removing step comprises laser ablating the first portion of the polymer layer to expose an area of the first surface of the first substrate.

22. The method of claim 21, wherein the polymer layer is selected from polymethylmethacrylate, polycarbonate, polytetrafluoroethylene, polyvinylchloride, polydimethylsiloxane, polysulfone, polystyrene, polymethylpentene, polypropylene, polyethylene, polyvinylidine fluoride, and acrylonitrile-butadiene-styrene copolymer.

23. The method of claim 21, wherein the first substrate is selected from glass, quartz, fused silica and silicon.

24. The method of claim 21, wherein the first substrate comprises a non-ablatable polymeric substrate that is not ablated under conditions used in ablation of the polymer layer.

25. A microfluidic device, comprising:

a first substrate layer having a first surface;

a first photoimagable polymer layer on the first surface of the first substrate, the photoimagable polymer layer having at least a first groove disposed therein in a desired location; and

a second planar substrate layer having a first surface, the first surface of the second substrate layer mated with and overlaying the photoimagable polymer layer.

26. The microfluidic device of claim 25, wherein at least one of the first and second planar substrates comprises glass.

27. The microfluidic device of claim 25, wherein at least one of the first and second planar substrates comprises a polymeric material.

28. The microfluidic device of claim 25, wherein the photoimagable polymer layer comprises a photoimagable polymer selected from photoimagable polyimides, photoimagable benzocyclobutenes, photoimagable epoxies, novolac based positive photoresists, and cardo type photopolymers.

29. The microfluidic device of claim 28, wherein the photoimagable polymer comprises an adhesive upper surface.

30. The microfluidic device of claim 25, wherein the photoimagable polymer layer is between about 1 and about 100 μm thick.

31. The microfluidic device of claim 25, wherein the layer of photoimagable polymer comprises a plurality of grooves disposed therein.

32. The microfluidic device of claim 31, wherein the plurality of grooves comprises at least two intersecting grooves.

33. The microfluidic device of claim 25, wherein the first and second substrate layers are selected independently from silica based substrates, polymer substrates and ceramic substrates.

34. The microfluidic device of claim 25, wherein at least one of the first and second substrates is selected from glass, quartz, fused silica and silicon.

35. The microfluidic device of claim 25, wherein at least one of the first and second substrates is selected from polymethylmethacrylate, polycarbonate, polytetrafluoroethylene, polyvinylchloride, polydimethylsiloxane, polysulfone, polystyrene, polymethylpentene, polypropylene, polyethylene, polyvinylidine fluoride, acrylonitrile-butadiene-styrene copolymer.

36. The microfluidic device of claim 25, wherein the polymer layer is between about 1 and 100 μm thick.

37. The microfluidic device of claim 25, wherein the polymer layer is between about 5 and about 50 μm thick.

38. The microfluidic device of claim 25, wherein the groove comprises an aspect ratio (depth:width) greater than 1.

39. The microfluidic device of claim 25, wherein the groove comprises an aspect ratio (depth:width) greater than 2.

40. The microfluidic device of claim 25, wherein the groove comprises an aspect ratio (depth:width) greater than 5.

41. The microfluidic device of claim 25, wherein the groove comprises an aspect ratio (depth:width) greater than 10.

42. The microfluidic device of claim 25, further comprising a second groove disposed in at least one of the first surface of the first substrate or the first surface of the second substrate.

43. The microfluidic device of claim 42, wherein the second groove intersects and is in fluid communication with the first groove in the polymer layer.

44. The microfluidic device of claim 25, further comprising:

a second photoimagable polymer layer disposed on a second surface of the second substrate opposite the first surface of the second substrate, the second photoimagable polymer layer having at least a second groove disposed therein in a desired location; and

a third planar substrate layer having a first surface, the first surface of the third substrate layer mated with and overlaying the second photoimagable polymer layer.

45. A microfluidic device, comprising:

a first non-ablatable substrate layer having a first surface;

a first ablatable polymer layer on the first surface of the first substrate, the polymer layer having at least a first groove laser ablated entirely through the polymer layer in a desired location without affecting the first surface of the first substrate; and

a second planar substrate layer having a first surface, the first surface of the second substrate layer mated with and overlaying the photoimagable polymer layer.

46. The microfluidic device of claim 45, wherein the first substrate comprises glass.

47. The microfluidic device of claim 45, wherein the polymer layer is selected from polymethylmethacrylate, polycarbonate, polytetrafluoroethylene, polyvinylchloride,

polydimethylsiloxane, polysulfone, polystyrene, polymethylpentene, polypropylene, polyethylene, polyvinylidine fluoride, acrylonitrile-butadiene-styrene copolymer.

48. The microfluidic device of claim 45, wherein at least one of the first and second planar substrates comprises a non-ablatable polymeric material.

49. The microfluidic device of claim 45, wherein the polymer layer comprises a plurality of grooves laser ablated therethrough.

50. The microfluidic device of claim 49, wherein the plurality of grooves comprises at least two intersecting grooves.

51. The microfluidic device of claim 45, wherein the first and second substrate layers are selected independently from silica based substrates, polymer substrates and ceramic substrates.

52. The microfluidic device of claim 45, wherein at least one of the first and second substrates is selected from glass, quartz, fused silica and silicon.

53. The microfluidic device of claim 45, wherein at least one of the first and second substrates is selected from polymethylmethacrylate, polycarbonate, polytetrafluoroethylene, polyvinylchloride, polydimethylsiloxane, polysulfone, polystyrene, polymethylpentene, polypropylene, polyethylene, polyvinylidine fluoride, acrylonitrile-butadiene-styrene copolymer, provided that if the first substrate is non-ablatable under conditions in which the polymer layer is ablated.

54. The microfluidic device of claim 45, further comprising a second groove disposed in at least one of the first surface of the first substrate or the first surface of the second substrate.

55. The microfluidic device of claim 54, wherein the second groove intersects and is in fluid communication with the first groove in the polymer layer.

56. The microfluidic device of claim 45, further comprising:

a second photoimagable polymer layer disposed on a second surface of the second substrate opposite the first surface of the second substrate, the second photoimagable polymer layer having at least a second groove disposed therein in a desired location; and

a third planar substrate layer having a first surface, the first surface of the third substrate layer mated with and overlaying the second photoimagable polymer layer.

57. An analytical system, comprising:

a microfluidic device, comprising:

a first substrate layer having a first surface;

a first photoimagable polymer layer on the first surface of the first substrate, the photoimagable polymer layer having one or more grooves disposed therein in a desired location; and

a second planar substrate layer having a first surface, the first surface of the second substrate layer mated with and overlaying the photoimagable polymer layer sealing the one or more grooves to define one or more microscale channels;

a material transport system for directing movement of material through the one or more microscale channels; and

a detector for detecting signals from the material.